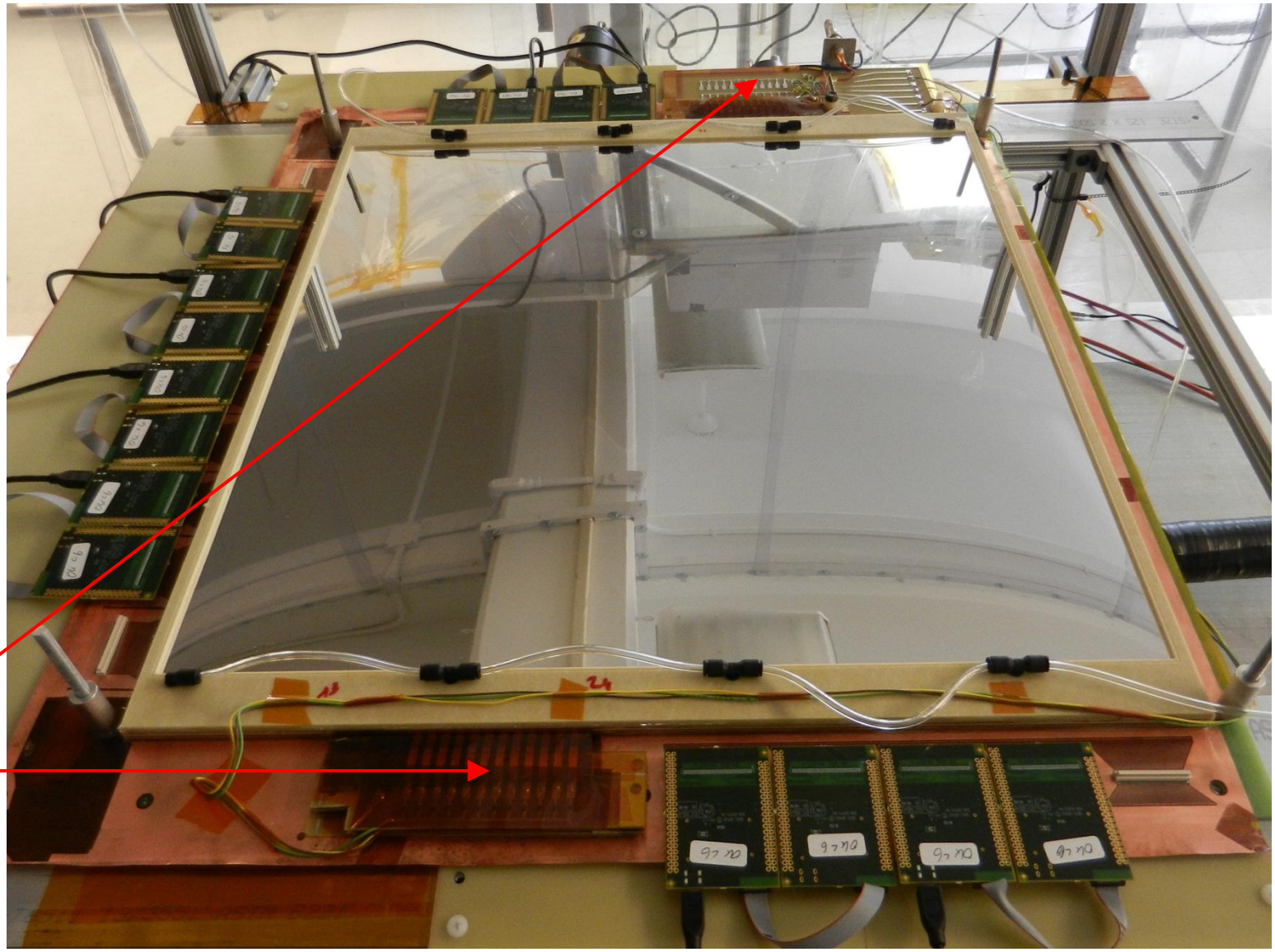
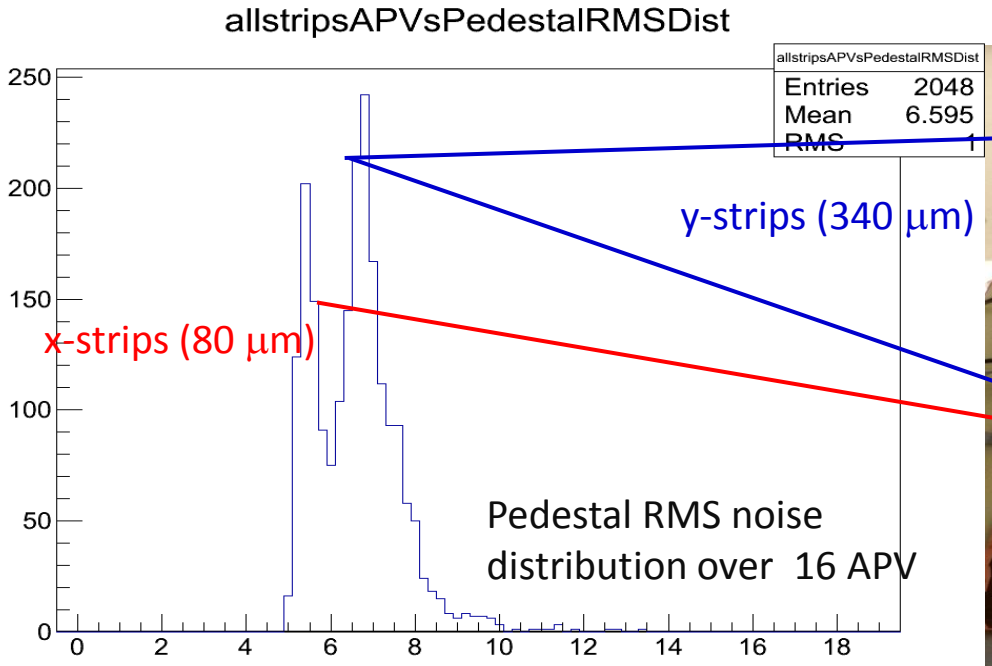
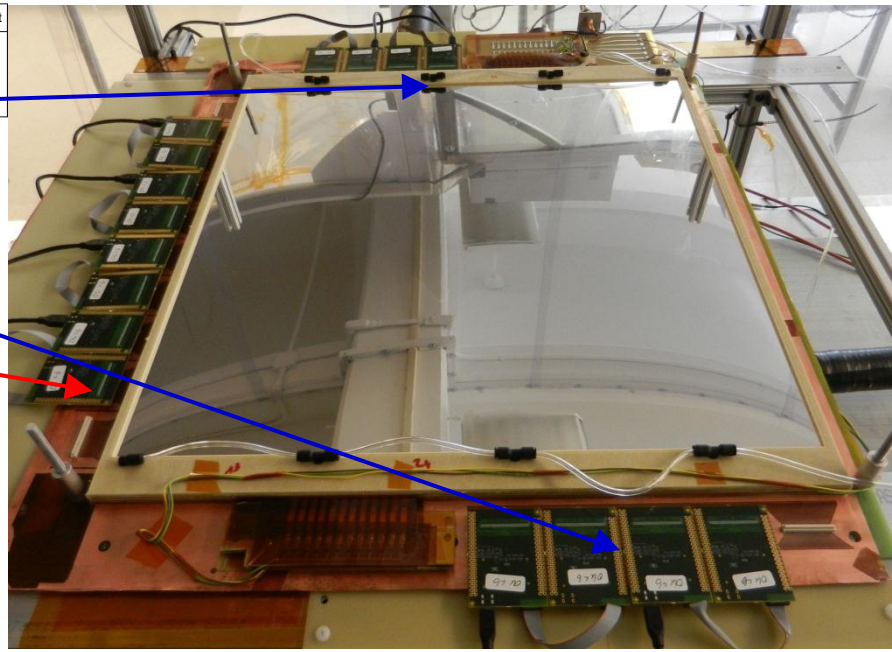
SBS Back Tracker 50 × 50 cm^2 Triple GEM proto1

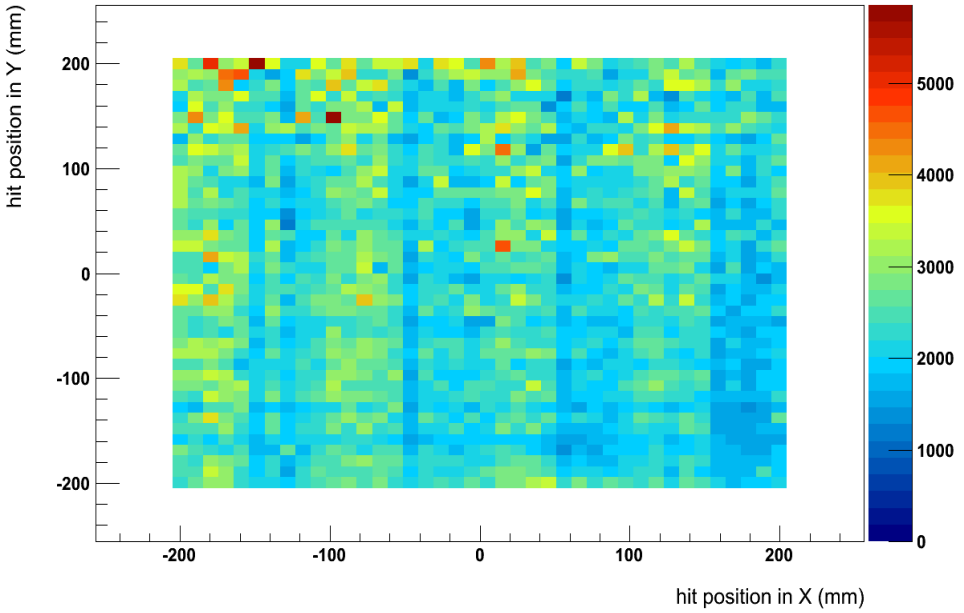


HV + Spark protection Board

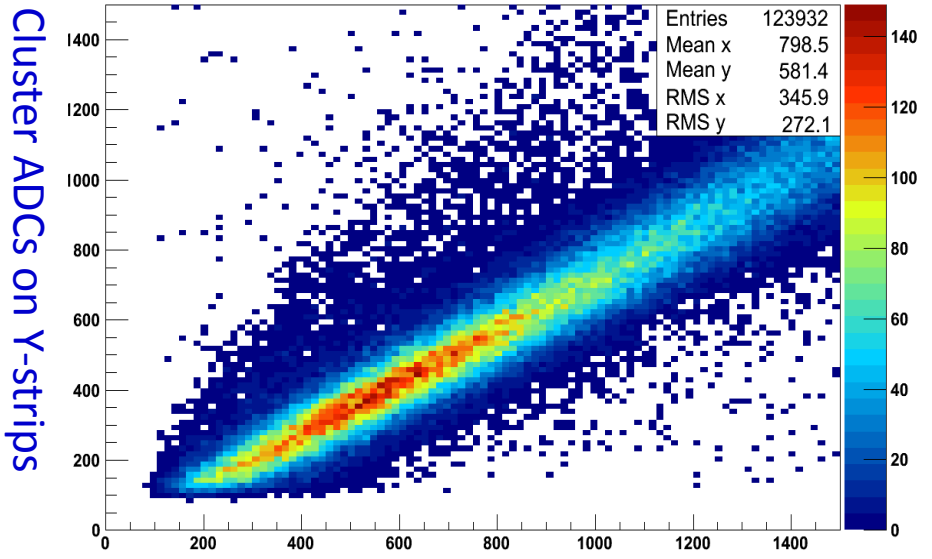




Mean ADC counts



SBS 50 cm x 50 cm Proto GEM1 2D Charge Sharing

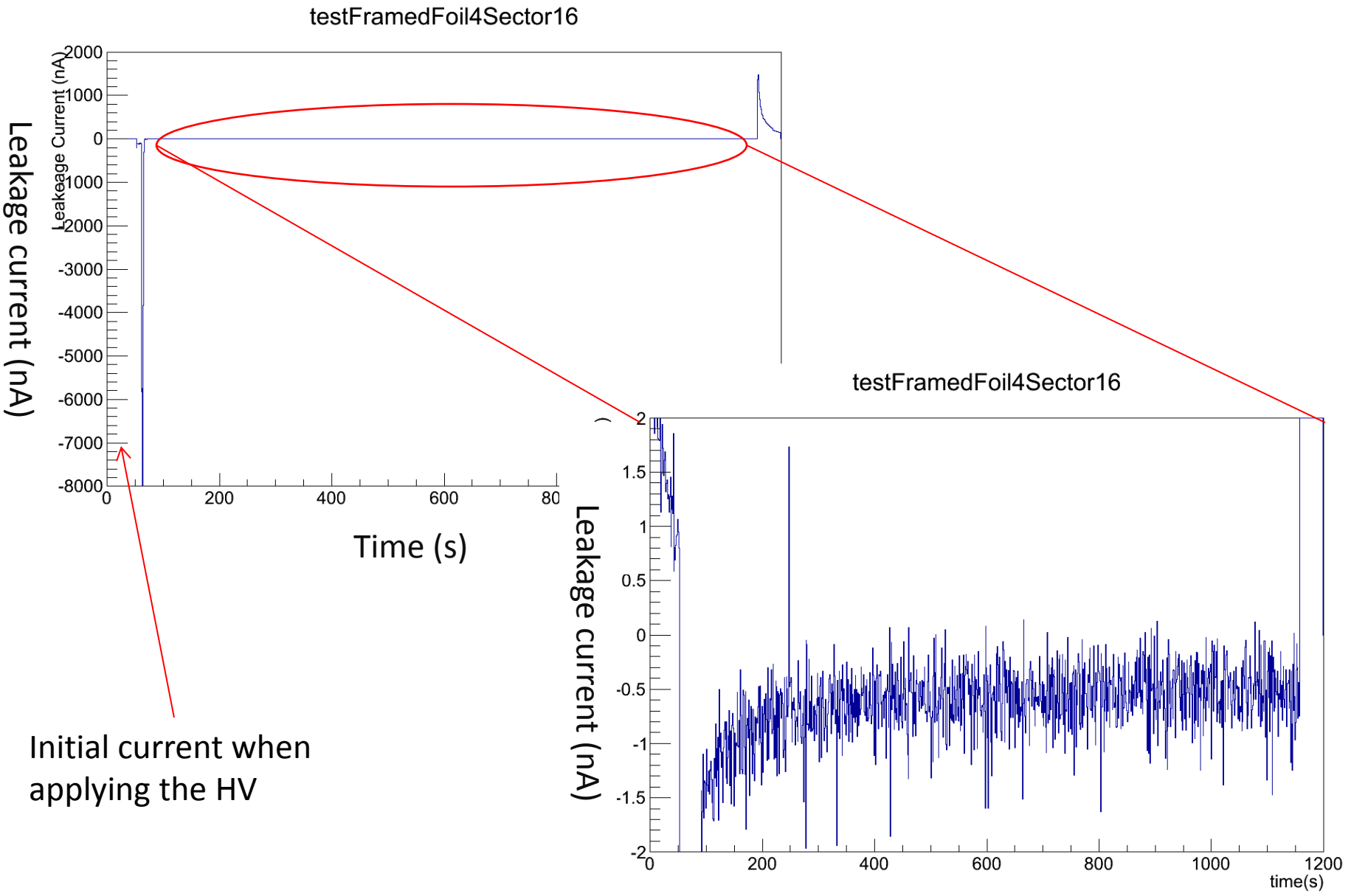


Cluster ADC counts on X-strips

HV test procedure

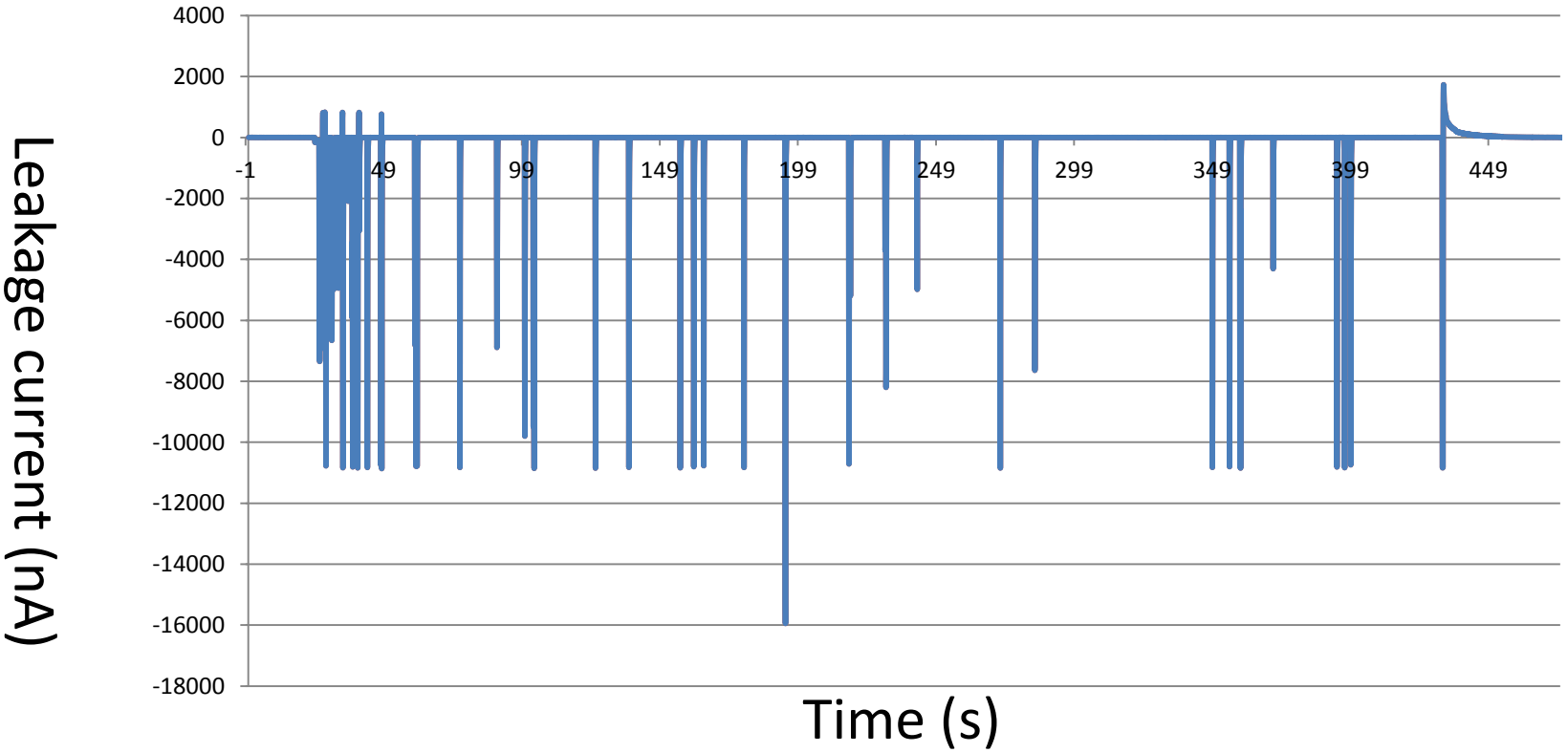
- We use an Iseg EHS 8060x_105 6 kV HV module with a Wiener MPOD high voltage crate. High voltage is controlled using a command line interface through an internet protocol.
- For the test we use the fast ramp up mode of the supply with a rate of 1200 V/s. the power supply is sampling the current on a millisecond scale and the trip occurs within a few milliseconds of current over limit.
- The leakage current drawn by the GEM foil is measured using a Keithley 6487 picoammeter, at a sampling rate of 120 ms read into the computer through a Labview interface and save the readings into a text file.
- A GEM sector has a capacitance of approximately 2 nF; and the resistance engaged in the HV module is ~ 50 MΩ, once the stable voltage is achieved this resistance is shunted automatically within the supply). As a result, when we are setting the required high voltage of 550 V, the initial current is a couple of μA, then quickly drops and stabilizes to about less 1 nA leakage current far better than the 5 nA requirement.

HV test of Sector16 from GEM2



Spark rate and amplitude on a dirty foil

- We tested the HV test procedure using a small 10 cm x10 cm GEM foil in the N2 box.
- Before the test, it was allowed to collect dust for 10 minutes outside the clean room.
- Series of current spikes corresponding to sparks in the GEM foil arising from dust particles burning.
  - The spike lasts a couple of hundred ms and current up 15 μA. Sparks are visible and audible.
  - After the spark the current goes down to ~1 nA level with no burn marks in the foil afterwards.
  - The spark rate decreases with time and the current stable at < 1 nA.

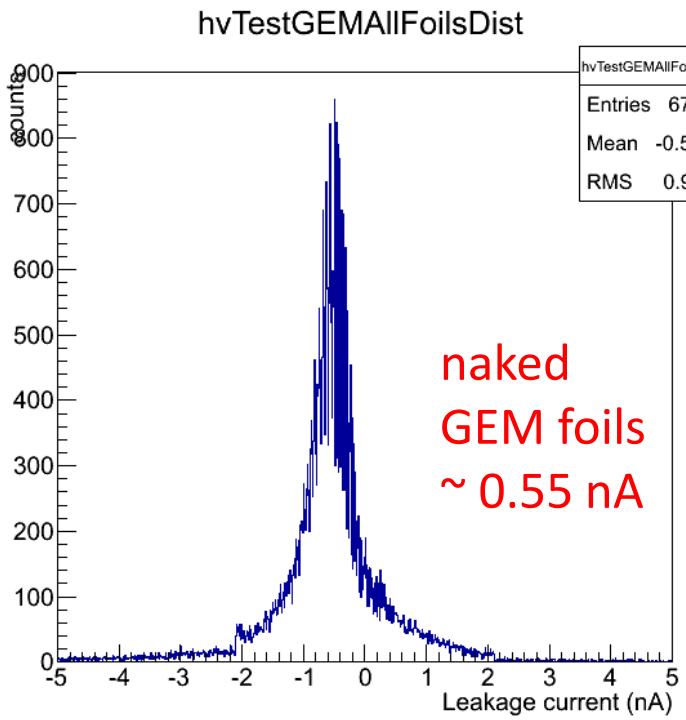


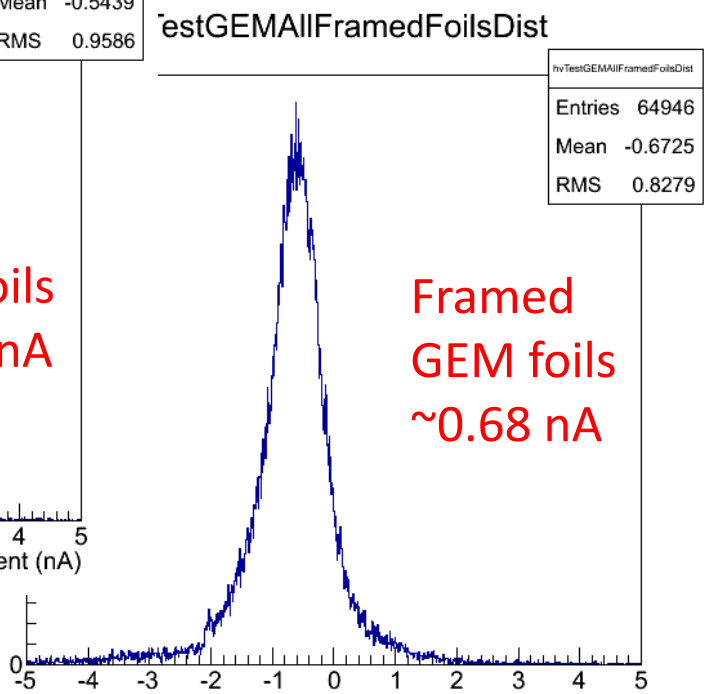
What we learned

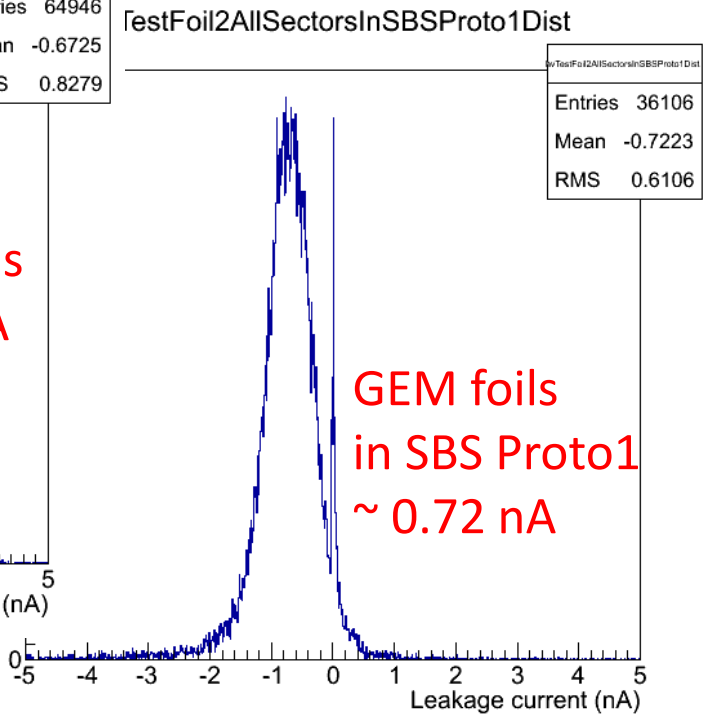
- Do not ramp up the HV slowly from 0 to 550 to test the foil instead one should directly apply the nominal test HV
  - ➔ See Rui's talk for explanation
- Limitation of the current should be set high enough to avoid trip and allow burning of the dust on the foil
  - ➔ In our case we set it at 15 μA
  - ➔ A trip of the HV power supply can be as bad as ramping the HV slowly
- When a sector has a lot of sparks and do not stabilize with 20 s ➔ stop the HV and let it dry under N2 for a couple of days
  - ➔ If the problem persists, send the foil back to Rui

HV test during the assembly of Proto1

- Distribution of leakage current over all the 72 sectors
- 24 sectors per foil ➔ 3 foils ➔ 72 sectors
- HV test at 550 V under N2 for naked, framed foils and in chamber foils







Curing of the sector12 on GEM1

Excess of glue leaked onto the sector during assembly ➔ sector can be recovered after curing on N2 or at 50 degree